



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/648,953	08/26/2003	Sean S. Kang	LAM1P177/P1139	4068
22434	7590	09/07/2005	EXAMINER	
BEYER WEAVER & THOMAS LLP			MALDONADO, JULIO J	
P.O. BOX 70250			ART UNIT	
OAKLAND, CA 94612-0250			PAPER NUMBER	
			2823	
DATE MAILED: 09/07/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/648,953

Applicant(s)

KANG ET AL.

Examiner

Julio J. Maldonado

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 June 2005.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-12,14-17,21-27 and 29-39 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☒ Claim(s) 21-23 and 25-27 is/are allowed.
6) ☒ Claim(s) 1,3-12,14-17,24,30,32,33,35 and 36 is/are rejected.
7) ☒ Claim(s) 31,34 and 37-39 is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The rejection as set forth in the Office Action mailed on 03/21/2005 is withdrawn in view of the newly found reference, Chien et al. 5,895,740.
2. Claims 1, 3-12, 14-17, 21-27 and 29-39 are pending in the Application.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1, 3-6, 9-12, 14-17, 24, 32, 33 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chien et al. (U.S. 5,895,740) in view of the following comments.

In reference to claims 1, 3, 6, 9, 10, 12, 14, 15, 16, 32, 33 and 35, Chien et al. (Figs.3-5) teach a method of forming a hole including the steps of forming a photoresist layer over a dielectric layer (34); patterning the photoresist layer to form photoresist features (38) with photoresist sidewalls (48), where the photoresist features (38) have a first critical dimension; plasma depositing a conformal layer (44) over the sidewalls (48) of the photoresist features (38) to reduce the critical dimensions of the photoresist features (38), wherein said conformal layer (44) is an organic polymer layer, wherein forming said polymer conformal layer (44) further includes controlling the reactant gas mixture ratio, power applied to the chamber, chamber pressure and cooling gas flow rate for the further advantage of achieving uniform thickness along the photoresist

Art Unit: 2823

sidewalls (48) and furthermore to control the thickness of said conformal layer (44) in order to control the size of the hole to be etched in the dielectric layer (34) and wherein the sidewall thickness is greater than a photoresist feature bottom thickness; and etching a hole (52) into the dielectric layer (34), wherein said hole (52) have a second critical dimension which is less than the first critical dimension, and wherein the forming of the conformal layer (44) and the etching of the dielectric layer (34) is performed in situ (column 4, line 60 – column 6, line 50).

Chien et al. fail to expressly teach said conformal layer depositing step includes a first and third deposition with a first gas chemistry to form a first deposition plasma and a second and fourth deposition with a second gas chemistry to form a second deposition plasma, wherein the first gas chemistry is different than the second gas chemistry. However, Chien et al. discloses that the changes of ratio are a result of effective variable that affects the thickness of the deposited layer (Chien et al., column 5, lines 43 – 62). It would have been obvious to one of ordinary skill in the art at the time the invention was made to change the reacting gas ratio to an amount which would not be expected to significantly affect the characteristics of the deposition process, that is, the claim is open to extremely small changes that would make them insignificant changes in ratios.

Chien et al. substantially teach all aspects of the invention but fail to disclose wherein the second critical dimension is not greater than 70% of the first critical dimension. However, Chien et al. teach wherein forming said polymer conformal layer includes controlling the reactant gas mixture ratio, power applied to the chamber,

Art Unit: 2823

chamber pressure and cooling gas flow rate for the further advantage of achieving constant thickness along the photoresist sidewalls and furthermore to control the thickness of said conformal layer in order to control the size of the hole to be etched in the dielectric layer (column 5, lines 43 – 61). Therefore, the selection of the claimed percent range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to obtain a hole with a desired critical thickness. Accordingly it would have been obvious to one of ordinary skill in the art at the time the invention was made to use Chien et al. to arrive at the claimed invention.

Chien et al. substantially teach all aspects of the invention but fail to disclose wherein the photoresist layer is formed from 248 nm photoresist and the feature has a CD not greater than 140. Notwithstanding, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert.

Art Unit: 2823

denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

In reference to claims 5 and 17, Chien et al. teach wherein the depositing the conformal layer over the sidewalls forms substantially vertical sidewalls (column 4, line 60 – column 6, line 50).

5. Claims 7, 8, 30 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chien et al. (U.S. 5,895,740) as applied to claims 1, 3-6, 9-12, 14-17, 24, 32, 33 and 35 above, and further in view of Yamamoto et al. (U.S. 4,151,034).

Chien et al. substantially teach all aspects of the invention but fail to disclose stripping the photoresist mask and deposited conformal layer with a single stripping step, wherein said stripping comprises ashing the photoresist mask and the deposited layer.

However, Yamamoto et al. teach a method of simultaneously etch a photoresist layer and a silicon nitride layer using ashing (column 1, lines 7 – 17). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Chien et al. with the teachings of Yamamoto to enable the etching step of Chien et al. to be performed according to the teachings of Yamamoto et al. because one of ordinary skill in the art at the time the invention was made would have been motivated to look to alternative suitable methods of performing the disclosed etching step of Chien et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine (MPEP 2144.07.), and furthermore, because this etching technique provide

easier operation, higher reliability and no environmental pollution compared to conventional etching processes (Yamamoto et al., column 1, lines 7 – 17).

Allowable Subject Matter

6. Claims 21-23 and 25-27 are allowed.
7. Claims 31, 34 and 37-39 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
8. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to teach wherein the depositing the conformal layer provides a portion of the bottom of the via without deposited conformal layer as recited in claims 21-23, 25-27, 31, 34 and 37; and wherein the first and second deposition are selected from the group of a bread-loafing depositing and a faceting depositing, and wherein the first deposition is different from the second deposition as recited in claims 38 and 39.

Response to Arguments

9. Applicant's arguments with respect to claims 1, 3-12, 14-17, 21-27 and 29-39 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

10. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (<http://portal.uspto.gov/external/portal/pair>) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.


Art Unit: 2823

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

12. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at <http://www.uspto.gov/web/info/2800.htm>.

Julio J. Maldonado
Patent Examiner
Art Unit 2823

Julio J. Maldonado
August 26, 2005


George Fourson
Primary Examiner